

REMARKS

In the Office Action, claims 1-51 were rejected. By the present response, claims 1, 2, 4, 6, 7, 10, 11, 13-16, 18, 19, 21, 22, 24, 25, 27-29, 31, 32, 35, 37, 39, 40, 43, 45, 46, and 48-51 are amended. Upon entry of the amendments, claims 1-51 will remain pending in the present patent application. Reconsideration and allowance of all pending claims are requested.

Objections to the Claims

The examiner objected claims 22, 28, 35, 37 and 43 due to certain informalities. Claims 22 and 37 have been amended to recite a ring-shaped cavity.

The examiner objected claim 28 and interpreted it to recite an electron storage ring in the cavity so that the electron storage ring overlaps the path of the high-energy optical pulses. The applicants respectfully submit that there is no editing error and the claim as such recites a portion of an electron storage ring 54 to overlap the ring-shaped cavity 12 such that the path of the electron beam 56 overlaps the path of the high-energy optical pulses. FIG. 3 clearly illustrates the recitation of the claim. It should be noted that the electron storage ring is not shown to be in the cavity as interpreted by the examiner. The electron storage ring may be within or outside the cavity insomuch as a portion of the electron storage ring overlaps the cavity. The applicants therefore request the objection to be withdrawn.

The examiner objected to claims 35 and 43 as there are no features recited in the claims to give antecedence to the “round trip time” of the optical pulses. The applicants respectfully submit that optical pulses are generated by a laser source within the ring-shaped cavity. It is the optical pulses circulating with the cavity and not the cavity itself that have a “round trip time” of circulation. The applicants therefore request the objection to be withdrawn.

Rejections Under 35 U.S.C. § 103

In the Office Action, claims 1-5, 7, 12, 13, 15-17, 19-23, 25-27, 45-47 and 49 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sprangle et al., U.S. Patent No. 5,353,291 (hereinafter “Sprangles”) in view of Srinivasan-Rao, U.S. Patent No. 6,459,766 (hereinafter “SR”). Claims 8-11 and 50-51 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sprangles and SR and further in view of Erbert et al., U.S. Patent No. 6,760,356 (hereinafter “Erbert”). Claims 6, 18, 24 and 48 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sprangles and SR and further in view of Weingarten et al., U.S. Patent Application No. 2003/0174741 (hereinafter “Weingartens”). Claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Sprangles and SR and further in view of Antonell et al., U.S. Patent Application No. 2001/0043667 (hereinafter “Antonells”). Claims 28-30, 32-38 and 40-44 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sprangles and SR and further in view of Hartemann et al., U.S. Patent No. 6,724,782 (hereinafter “Hartemanns”). Claims 31 and 39 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sprangles, SR and Hartemanns and further in view of Weingartens.

Applicants respectfully assert that the present invention, as recited in amended independent claims 1, 15, 22, 28, 37 and 45 is patentable over Sprangles, SR and Hartemanns either alone or in combination.

Independent claims 1, 15, 22, 28, 37 and 45 are amended to more clearly point out certain of the claimed subject matter. Specifically, each independent claim now recites, in generally similar language, *that the laser source is disposed in a ring-shaped cavity to generate optical pulses in a first direction*. Applicants respectfully submit that the claims have been amended to recite a ring-shaped cavity in place of a vacuum cavity, as the specification does not provide clear support for the vacuum cavity, though a vacuum may be maintained inside the ring-shaped cavity so as to facilitate the process of X-ray generation.

Additionally, the Applicants would like to point out that **the interaction between the high-energy optical pulses and the pulsed electron beam takes place within the same cavity in which the laser source, such as a laser rod, is located.**

The Sprangles reference discloses a laser source 22 that generates a laser beam 12. In addition, the Sprangles reference states that the laser beam 12 enters the ring resonator 56 formed by mirrors 26, 28, 34 and 36. **However, the reference does not teach or suggest a laser source present within the interaction chamber or even within the ring resonator.** Even the examiner stated, “Sprangle fails to specifically teach that the laser source is within a vacuum cavity.”

The laser source (a solid state laser rod 42) described in the present application is located within the ring-shaped cavity in which the interaction (inverse Compton scattering) takes place. Thus, the laser beam 16 is *generated within* the cavity 20 and no external laser source is required. Applicants respectfully submit that the pump laser 38 as described in the present application is not same as the laser source 22 as disclosed in Sprangles, as it is only used to initiate the generation of laser in the laser source (the solid state laser rod 42) disposed inside the ring-shaped cavity.

Further, a high-energy laser beam 16 is generated within the cavity 20 by the laser source described in the application. No external Table-Top Terawatt (T3) laser system 22 is employed for generating a high-energy laser beam as disclosed by Sprangles (*see, Sprangles, column 2, line 6-20*). The generation of the high-energy laser beam 16, in the claimed arrangement, is local to the cavity 20 in which interaction takes place.

Applicants respectfully submit that **the generation of the high-energy laser beam without the use of teh external Table-Top Terawatt (T3) laser system is possible due to the placement of laser source within the cavity.** The internal laser source acts as a regenerative amplifier and therefore generates the high-energy laser beam.

SR fails to obviate this deficiency in the teachings of Sprangles. **SR clearly does not show the scatter laser source 16 to be within the interaction ring 20 (see, SR, FIG. 1-3).** The examiner stated that “SR teaches means to recycle an electron beam 14 while simultaneously circulating a laser beam 18 for the purpose of generating X-rays 22 in a vacuum cavity.” Clearly, this is not same as generating the optical pulses within the same cavity in which the interaction between the optical pulses and the electron beam takes place to generate X-rays. The reference therefore does not teach or suggest placing the laser source within the cavity in which such interaction takes place. Consequently, the combination of Sprangles and SR simply cannot suggest to one skilled in the art all of the recitations of claims 1, 15, 22, 28, 37 and 45.

The Sprangles and SR references cannot be fairly combined as suggested by the examiner. The examiner stated that “it would have been obvious to one of ordinary skilled in the art at the time the invention was made to contain the device of Sprangle in a vacuum cavity as taught by SR since the containment would allow circulation of electrons with minimal energy loss.” The mere fact that SR discloses a vacuum cavity surrounding the elements for the purpose of circulating the electrons with minimal energy loss and an optional amplifier in the vacuum cavity to boost the laser signal between mirrors is not sufficient to teach or suggest one skilled in the art the to supply a laser source within the cavity so as to generate optical pulses within the same cavity in which interaction takes place. Indeed, the reference teaches away from such an arrangement so as to generate the optical pulses within the cavity. The interaction ring disclosed in SR is a modified form of an electron beam storage ring in which the electrons are circulated with minimum energy loss. It does not relate at all to the cavity claimed in the present application where a laser source is placed to generate optical pulses within the same cavity in which interaction takes place. **Accordingly, even if combined, the Sprangles and SR references provide no teaching whatsoever of a laser source placed within the cavity in which interaction takes place as recited in the claims.**

In view of the forgoing considerations, Applicants contend that the references fail to establish a *prima facie* case of obviousness of claims 1, 15, 22, 28, 37 and 45. These claims and the claims depending therefrom are therefore believed to be clearly patentable over the cited combination, and over combinations with the other secondary references. Thus, it is respectfully requested that the rejections of claims 1-51 under 35 U.S.C. §103(a) be withdrawn.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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